



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF  
SOLID WASTE AND EMERGENCY  
RESPONSE

April 11, 2008

**MEMORANDUM**

**SUBJECT:** National Remedy Review Board Recommendations for the Hanford Site,  
200-ZP-1 Ground Water Operable Unit

**FROM:** David E. Cooper, Chair  
National Remedy Review Board

A handwritten signature in black ink, appearing to read "David E. Cooper", is written over the printed name and title.

**TO:** Daniel Opalski, Director  
Office of Environmental Cleanup  
U.S. EPA Region X

**Purpose**

The National Remedy Review Board (the Board) has completed its review of the proposed cleanup action for the Hanford Site, 200-ZP-1 Ground Water Operable Unit in Benton County, Washington. This memorandum documents the Board's advisory recommendations.

**Context for Board Review**

The Administrator announced the Board as one of the October 1995 Superfund Administrative Reforms to help control response costs and promote consistent and cost-effective decisions. The Board furthers these goals by providing a cross-regional, management-level, "real time" review of high cost proposed response actions prior to their being issued for public comment. The Board reviews all proposed cleanup actions that exceed its cost-based review criteria.

The Board evaluates the proposed actions for consistency with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and relevant Superfund policy and guidance. It focuses on the nature and complexity of the site; health and environmental risks; the range of alternatives that address site risks; the quality and reasonableness of the cost estimates for alternatives; regional, state/tribal, and other stakeholder opinions on the proposed actions; and any other relevant factors.

Generally, the Board makes advisory recommendations to the appropriate regional decision maker. The Region will then include these recommendations in the administrative record for the site, typically before it issues the proposed cleanup plan for public comment.



While the Region is expected to give the Board's recommendations substantial weight, other important factors, such as subsequent public comment or technical analyses of response options, may influence the Region's final decision. The Board expects the regional decision maker to respond in writing to its recommendations within a reasonable period of time, noting in particular how the recommendations influenced the proposed cleanup decision, including any effect on the estimated cost of the action. It is important to remember that the Board does not change the Agency's current delegations or alter in any way the public's role in site decisions.

## **Overview of the Proposed Action**

The Hanford Site is a 586 square mile Department of Energy (DOE) facility located in southeastern Washington that manufactured nuclear materials for the nation's defense from 1943 through 1988. From the 1940s through the 1980s, liquid wastes from materials used and produced at Hanford (e.g., solvents, mixed fission products, process chemicals, and analytical laboratory chemicals) were disposed in seepage pits known as cribs and trenches, as well as in tanks. Some of these disposal sites are located on the Central Plateau portion of the Hanford Site and overlie the groundwater in the 200-ZP-1 area. The primary contaminants include carbon tetrachloride, trichloroethylene (TCE), hexavalent chromium, nitrate, technetium 99 (Tc-99), iodine 129, and tritium. In the mid 1990s, a groundwater pump-and-treat system was installed as an interim cleanup measure. This remediation system extracts groundwater down gradient of the former disposal sites, where carbon tetrachloride contamination impacted the groundwater. The system treats contaminated water using air stripping to remove carbon tetrachloride (and similar constituents) and then reinjects the treated water into groundwater up gradient of the extraction area. The remedy under consideration here would be a final action for the ground water in the 200-ZP-1 area. The preferred alternative includes treatment for inorganic contaminants and plume management by extraction, treatment, and reinjection of ground water.

## **NRRB Advisory Recommendations**

The Board reviewed the information package describing this proposal and discussed related issues with Dennis Faulk of your staff on March 5, 2008. Based on this review and discussion, the Board offers the following comments:

1. In the package presented to the Board, the time and cost estimates, as well as the cost and effectiveness analysis for the pump and treat system, were based on a very simplistic model. The Board recommends that DOE conduct a more robust modeling analysis to better understand remediation timeframes. Current restoration timeframe estimates seem overly optimistic. The Board believes that additional information is needed to better understand the restoration timeframes. In addition, the Board recommends that the decision documents should be clear that the remediation goals are numerical standards such as MCLs or risk-based concentrations rather than a specific mass removal. The Board is encouraged that DOE is pursuing a restoration remedy at this site. However, the package presented to the Board did not provide data to determine whether either proposed extraction rate could achieve cleanup goals during the predicted timeframes. The Board recommends that the preferred alternative be more fully

evaluated to determine whether it could achieve cleanup goals within the targeted timeframes under the extraction rates proposed.

2. The remedy preferred by DOE included a ground water extraction and treatment system to address ground water contamination. The preferred remedy included two ground water extraction rates; however, no clear rationale was presented for how a final flow rate decision would be made between the two. The two options were for ground water extraction at 840 gallons per minute (GPM) and 1615 GPM with associated present worth costs of \$93 M and \$180 M, respectively. The stated benefit of the larger system is to reduce the time to achieve cleanup goals from about 50 years to 25 years. Based on information presented to it, the Board was not clear which pumping rate should be considered the preferred alternative. Because the radiological contamination at this site will require long-term management of wastes and ground water use restrictions, the board questions the need for the more rapid ground water cleanup and the additional costs of the larger system. DOE can use the results of the more robust modeling recommended in comment 1 to evaluate whether the higher pumping rate is cost effective. The board recommends that DOE clearly select a ground water extraction rate, and the associated system capacity, and provide the rationale in the decision documents.

3. The preferred remedial alternative assumes that DNAPL is not present in the saturated zone and is not present in significant quantities, if at all, in the vadose zone. However, carbon tetrachloride concentrations and spatial distribution data presented to the Board (taken from annual ground water monitoring reports) suggest that DNAPL source zones may exist in the subsurface. The preferred alternative includes a contingency to address DNAPL material in the saturated and vadose zone, if found. The two options presented to the Board were electric heating and biological treatment. The cost for the heating option is \$175M compared to \$25 M for anaerobic biodegradation. Because DOE has not been able to identify or delineate DNAPL in the subsurface, has not fully developed alternatives to address possible DNAPL nor evaluated the potential effectiveness of those alternatives, nor described criteria for invoking the contingency, the Board recommends that the contingencies should not be included in the decision documents until these issues have been further evaluated.

4. The preferred alternative includes reinjection of treated ground water to control plume migration and speed up ground water restoration. However, in the package presented to the Board, it appears that extracted ground water would not be treated for all contaminants (e.g., tritium, iodine 129) before reinjection. In addition, the Board is concerned that some of the water reinjected up gradient of the capture system would not be captured by down gradient capture wells. The Board recommends that the Region review the reinjection strategy, which should be discussed in the decision documents, along with targets developed for reinjected ground water.

5. The goal of the pump and treat system for the Hanford 200-ZP-1 OU is to capture the contaminant plume and restore water quality within the plume boundaries. Because of the large lateral and vertical extent of the plume, the complexity of the subsurface geology, and the contaminant source distribution, the monitoring system design will be critical to evaluating the

performance of the pump and treat system, as well as ensuring plume containment and clean-up of contaminated ground water. The Board recommends that DOE develop an appropriate strategy to monitor water quality and hydraulic heads during the remedy design phase. EPA guidance on capture zone analysis (see U.S. EPA, 2008, "A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems," EPA/600/R-08/003) should be consulted during development of the monitoring plan.

6. As presented to the board, monitored natural attenuation (MNA) is proposed as a remedial alternative to treat the ground water contamination in the distal portion of the plume for carbon tetrachloride for the Hanford 200-ZP-1 OU. Organic contaminants (e.g., carbon tetrachloride) as well as radionuclides are present in the ground water and vadose zone at high concentrations. Given the complexity of the site and the presence of multiple contaminants (organic and inorganic, radionuclides, transformation products and radionuclide decay daughters) and the variation in the site's hydrologic conditions as well as geochemical conditions, and reinjection of treated ground water, natural attenuation processes will be very complex and the rates of attenuation will be contaminant specific. Based on the information provided in the package, the Board believes that MNA has not been evaluated to the degree necessary to consider it an appropriate remedy for the site.

The Board recommends that decision documents provide supporting evidence for natural attenuation (e.g., site-specific attenuation mechanisms) and should provide estimates for attenuation rates and timeframes for achieving ground water cleanup criteria consistent with Agency guidance on MNA. (see e.g., "Use Of Monitored Natural Attenuation At Superfund, RCRA Corrective Action, And Underground Storage Tank Sites," OSWER Directive 9200.4-17P April 21, 1999; "Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 1 - Technical Basis for Assessments," EPA/600/R-07/139 October 2007; "Monitored Natural Attenuation of Inorganic Contaminants in Ground Water Volume 2 - Assessment for Non-Radionuclides Including Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Nitrate, Perchlorate, and Selenium," EPA/600/R-07/140 October 2007). The decision documents should identify mechanisms of natural attenuation for all contaminants for which MNA is being selected. These mechanisms, which may be different under different conditions, should be identified for the range of hydrologic and geochemical settings encountered at the site. This information includes determining the organic transformation products, radionuclide isotopes and daughters, identifying the immobilization processes and rates that may be present or become present in both the vadose and ground water environments.

Furthermore, MNA is not appropriate for contaminate plumes that are not stable or are expanding (see "Use Of Monitored Natural Attenuation At Superfund, RCRA Corrective Action, And Underground Storage Tank Sites," OSWER Directive 9200.4-17P April 21, 1999, p. 17) and the package presented to the Board indicated that this plume is not stable. Therefore, even if MNA is supported by the above evaluation, it should only be proposed for portions of the plume which are shrinking or stable. Alternatively, the Board recommends evaluating whether a shorter remediation timeframe could be achieved by capturing the lesser concentrated portions of the plume with minimal additional cost.

7. The Board did not have sufficient information to evaluate the role of Washington Model Toxics Control Act (MTCA) at this site and whether MTCA Method B is an ARAR at this site. However, it may be appropriate to use it as a “to-be-considered” guidance (TBC) in developing soil cleanup levels. To the extent MTCA might be considered as an ARAR, the Board notes that the stringent cleanup levels identified by the state may not be achievable with current technology. The Board recommends that the Region, DOE, and the state work together in evaluating the appropriate role of MTCA in designing a remedial action that will protect human health and the environment.

8. The package presented to the Board included a remedial action objective (RAO) to prevent or mitigate risks in ground water where concentrations exceed ARARs or a  $1 \times 10^{-4}$  cancer risk level. The Board notes that this approach is inconsistent with the NCP’s point of departure of  $10^{-6}$  (see 40 CFR §300.430(e)(2)(i)(A)(2)). While a remedial action can be selected that does not meet the point of departure (see 55 FR 8718, March 8, 1990), the rationale for doing so should be described in the site decision documents. In particular, the NCP preamble states: “Preliminary remediation goals for carcinogens are set at a  $10^{-6}$  excess cancer risk as a point of departure, but may be revised to a different risk level within the acceptable risk range based on the consideration of appropriate factors including, but not limited to: exposure factors, uncertainty factors, and technical factors” (see 55 FR 8717, March 8, 1990). Furthermore, the decision documents need to be clear whether the cleanup is based on a risk based number or an ARAR. Risk based radionuclide cleanup levels may be developed using Agency guidance (e.g., electronic calculator entitled: “Radionuclide Preliminary Remediation Goals (PRGs) for Superfund” (<http://epa-prgs.ornl.gov/radionuclides/>)).

9. The package presented to the Board indicates that five-year reviews will stop when the  $1 \times 10^{-4}$  cancer risk level based on industrial risk is met. The Board notes that this is inconsistent with the NCP. Pursuant to CERCLA and the NCP, a five-year review is required whenever a selected remedy leaves hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Exposures associated with industrial land use are not considered unlimited nor unrestricted and such sites typically would be under some form of institutional control (see “Institutional Controls: A Site Manager’s Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups,” OSWER Directive 9355.0-74FS-P, September 2000).

10. The package presented to the board includes an RAO to “prevent or mitigate occupational health risks to workers performing remedial action.” While the Board believes that worker health and safety is extremely important, the Board notes that this issue seems to have been incorrectly identified an RAO. RAOs specify contaminants and media of concern, potential exposure pathways and remediation goals (i.e., acceptable exposure levels that are protective of human health and the environment: see 40 CFR §300.430(e)(2)(i)), but do not typically specify how those goals are met. Worker safety may be addressed under short-term effectiveness as part of the nine criteria analysis, where “potential impacts on workers during remedial action and the effectiveness and reliability of protective measures” is explicitly considered (40 CFR

§300.430(e)(9)(iii)(E)). Including this as an RAO may give the mistaken impression that prevention of any worker risks is similar to a threshold criterion, and result in arguments for remedial alternatives that do not take any active remediation since these will generally have some inherent worker risk.

11. The Board was not presented much information on Tc-99, a radioactive contaminant in the vadose zone and ground water. In particular, the extent of Tc-99 in vadose zone is unclear. In addition, the Board was not presented information as to the specific oxidation state of the Tc-99, which can influence mobility of the contaminant in the vadose zone. The preferred alternative is premised on the belief that the Tc-99 in vadose zone will be captured by this ground water pump and treat system. The Board recommends that DOE further characterize Tc-99 in the vadose zone and minimize the amount of Tc-99 that gets to the groundwater. The Board recognizes that EPA is working with DOE on treatability studies to address the vadose zone Tc-99 and encourages this effort. Redox chemistry issues are also likely to be important for other elements, such as chromium and uranium and other contaminants that can exist in different oxidized states.

12. The proposed plan is intended to be a final remedy for the ground water in the 200 West area. However, according to the package presented to the Board, the presence of contaminant sources, particularly of Tc-99, in the vadose zone is not well characterized. Consequently, the Region is uncertain about the quantity and extent of source material remaining in the vadose zone and its contribution to ground water contamination. The Board notes that the amount of source remaining in the vadose zone could affect the duration required to pump and treat ground water contamination. Following the further investigations recommended in comment 11, DOE will better understand the impacts of the remaining sources of Tc-99 in vadose.

The Board appreciates the Region's efforts in working together with DOE, the State, and community groups at this site. We request that a draft response to these findings be included with the draft Proposed Plan when it is forwarded to your OSRTI Regional Support Branch for review. The Regional Support Branch will work with both your staff and me to resolve any remaining issues prior to the release of the Proposed Plan. Once the response is final and made part of the site's Administrative Record, then a copy of this letter and your response will be posted on the Board's website (<http://www.epa.gov/superfund/programs/nrrb/>).

Thank you for your support and the support of your managers and staff in preparing for this review. Please call me at (703) 603-8763 should you have any questions.

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